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Shahid, Mishel; Freeman, Ruth

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What is the function of psychosocial factors in predicting length of time since last dental visit? A secondary data analysis

Mishel Shahid 1,2

Ruth Freeman 2,3

Department of Community Dentistry, Institute of Dentistry, CMH Lahore Medical College

Dental Health Services Research Unit, School of Dentistry, University of Dundee

Public Health, NHS Tayside

Corresponding author:

Professor Ruth Freeman, DHSRU, Dundee Dental Education, Frankland Building, Dundee, DD1 4HN

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Abstract

Aim: To conduct a secondary analysis of the Adult Dental Health Survey, UK (ADHS.UK) data to investigate the function of (i) psychosocial factors (costs, dental anxiety, communication) and whether their interaction mediates the relationship between perception of need and length of time since last dental visit.

Methods: The data used from the ADHS.UK interview questionnaires included demography, costs, perception of treatment need, communication, dental anxiety and reported dental attendance. The data was subjected to X2-analysis and hierarchical logistic regression analysis.

Results: Time since last dental visit was significantly associated with all demographic and psychosocial variables. The hierarchical logistic regression analysis tested 3 models. Model 1 examined the demography and explained 2% of the variance. Model 2 showed that those in intermediate (e.g. clerical staff) and routine (e.g. agriculture workers) occupations and those who were unemployed/never worked had a greater likelihood of increased interval between dental visits, explaining an additional 2% of the variance of the time interval between dental visits. Model 3 provided an additional 10% of the variance, which included costs, perceived need, communication and dental anxiety. The interaction of the perception of need by extreme dental anxiety (OR = 0.52; 95%CI: 0.40, 0.69), improved the fit of the model ($X2$ (df1) = 22.85, $p< 0.001$).

Conclusion: This study revealed that dental anxiety, communication and treatment costs acted as barriers to accessing dental care. Dental anxiety acted as a mediator in the relationship between perception of need and increased time interval between dental visits.

Introduction:

In 2004 the National Institute for Clinical Excellence, in England, developed an evidence-based guidance on the timing of dental recall visits. The guidance 'purpose was to help clinicians assign recall intervals between oral health reviews that was appropriate to the [psychosocial and treatment] needs of the individual patients' [1]. The core of the guidance was for the dentist to adopt a patient-centred approach so that the 'interval' of time between dental appointments was dependent upon the patient's dental and medical need and upon psychosocial factors, such as, for example, costs of treatment and dental anxiety status [1]. For the first time the importance of psychosocial influences as stated by Cohen [2] and later by Finch et al's [3], were operationalized and incorporated into dentists' assessments of the interval or length of time between recall appointments.

With the introduction of the NICE guidance, the importance of psychosocial factors, continued to be recognised [4-9]. Research by Armfield [5,6] specifically examined the barrier of dental anxiety together with additional factors such as the role of health behaviours, costs of treatment and coping strategies in a population of dentally anxious adults. This research [5,6] along with others [9] supported the view that dentally anxious adults delayed the length of time between dental visits, however, and more importantly, it also suggested that other factors in unison affected attendance. For instance, Armfield [5,6] found that two-thirds of an Australian representative sample delayed dental treatment not simply because of dental anxiety but also because of the costs of treatment. The relationship, however, between delay, due to cost, was not directly related to household income, since those from high and low household income groups did not delay dental visits, whereas those from middle income groups did. With regard to patient perception of treatment need, Baker [9], showed that patient perception of need acted as a strong predictor of service use, however, the interaction between increased duration between dental visits and perception of treatment need illustrated the complexity between the various psychosocial factors. Moreover, this work [9] and others [8-10] showed that costs had a substantial function in threlationship between need perception and access to dental care, that is, it appeared to act as a mediator between perception of treatment need and access to care. For older people, the relationship with the dental professional and specifically communication, affected timely access to dental care [11]. The explanatory contribution of psychosocial factors both individually and in combination suggested, therefore, that dental anxiety, costs of treatment and communication could act as mediators in the relationship between patient perception of need and delay in accessing to dental care [5,6,8-10].

Conceptual model:

Thus we propose that in order to understand the role of psychosocial factors, a conceptual model based upon the hypothesis that psychosocial factors interact and act as mediators between patient perception of treatment need and the length of time between dental visits should be examined. Adopting this approach would provide additional evidence to support the importance of the role of psychosocial factors with regard to length of time between dental visits.

The population data from the Adult Dental Health Survey. UK (ADHS.UK) 2009 [12], contains questions pertaining to demography, psychosocial factors and history of access to dental care, which were used as inclusion criteria. Although, this data set has been used previously to report on psychosocial factors and oral health behaviours [7], it has not been used to predict or investigate the function of the interaction of the psychosocial variables as predictors of dental access. Therefore the aim of this study was to conduct a secondary analysis of the ADHS.UK data [10] to investigate first the function of (i) psychosocial factors and (ii) whether their interaction (dental anxiety, costs and communication) mediates the relationship between patient perception of need and length of time since last dental visit.

Methods:

Sample

The data used in this secondary analysis was from the ADHS.UK in 2009. A two-stage clustering sample technique was used consisting of 268 primary sampling units in England, Wales and Northern Ireland. This resulted in 13,400 addresses of which 12,054 households met the inclusion criteria. Sixty percent of these households (7,233) took part. Of the 13,509 adults residing in these households only 11,382 adults the age of 16 years and over participated (84%). Therefore the total sample size was 11,382. The mean age of the sample was 50.21 (18.27) years and 55% were female [12].

Survey data: questionnaire

The survey comprised of a number of questions relating to demographic factors including age, gender and socio-economic position. Factors relating to dental attendance including costs of dental treatment, dental anxiety, dentist-patient communication (i.e. the dentist listens carefully), perception of treatment need as well as questions relating to access for dental care, such as ‘when was your last visit to the dentist?’ were included in the questionnaire.

Survey data: variables

Gender, ethnicity, the dentist listened carefully and perception of treatment need, were assessed as yes/no questions: socio-economic position was assessed using National Statistics Socio-economic Classification (NS-SEC) (three class version) [13]. The three class version includes managerial, administrative and professional occupations; intermediate occupations, e.g. auxiliary, clerical or technical occupations; routine occupations e.g. sales, service or craft occupations. In the NS-SEC, the last category is those who have never work or long-term unemployed. Age was categorised into 3 age groups (16-34 years, 35-54 years, 55 years and over), as derived post data collection by the ADHS.UK [12].

Length of time since last dental visit was assessed by the question 'When was your last visit to the dentist?' The response system to the question, 'When was yourlast visit to the dentist?' were on a 7-point scale. The scale ranged from 'within six months' to '10 years or more' [12]. The dependent variable 'when was your last visit to the dentist' assessed the duration since last recall visit. Responses to 'when was your last visit to the dentist' were dichotomized using a median split: those who last accessed the dentist 6 months or less (n=6323) and those who last accessed the dentist 7 months or more (n=4,850). Previous access within a 6 month period = 0; greater than or equal to 7 months=1. The independent variables were age group (55 years and over=0; 16-34 years=1; 35-54=2), gender (female=0; male=1), ethnicity (white=0: other groups=1), SEP (managerial and professional=0; intermediate (non-manual) =1; routine or manual =2; unemployed/never worked=3) [13], dental anxiety (Modified Dental Anxiety Scale [MDAS] scores: 5-18=0; MDAS scores: 19-25=1) [14], perception of dental treatment need (no=0; yes=1), cost of treatment (amount paid for last course of treatment: £19 or less=0; £20-£59=1: £60 plus=2) and the dentist-patient communication (listening: yes:=0: no =1).

Respondents were asked to state the amount they paid for dental treatment: this ranged from £0 to £9,000 (2009 values). The data was split into three categories rather than being dichotomized in order to minimize the loss of treatment cost information. The trichotomized data was coded and so those paying £19 or less (n=5602) were awarded a score of 0; those paying £20-£60 (n=2605) and those paying over £61 (n=2339) were given scores of 1 and 2 respectively.

Statistical analysis:

The data was entered into SPSS Version 22 and subjected to X2 analysis to examine the association between demographic and psychosocial factors with duration (length of time) since last access for dental care. Hierarchal logistic regression analysis was used to examine the role of the first hierarchy

demography (that is: gender age and ethnicity); the second hierarchy, socio-economic position (SEP) and the third hierarchy, psychosocial factors (that is: costs, perception of treatment need, the dentist-patient communication and dental anxiety) upon duration sinclast dental visit. Using one cluster of independent variables at a time, was adopted, since this approach provides helpful additional information on the nature of these detailed relationships variables to the dependent variable. Significant level was 5% two-sided.

Results:

The results are presented in the following order: X2 analysis (Table 1) followed by the hierarchical logistic regression analysis (Table 2).

Duration since last dental visit was significantly associated with all demographic and psychosocial variables (P<0.001) as demonstrated in Table 1. Specifically reducing age, being male, having routine/manual employment or being long-term unemployment, belonging to an ethnic minority group, having greater perception of need, poorer dentist-patient communication and having extreme dental anxiety were all associated with increased duration between dental visits.

Table 2 presents the results of the hierarchical logistic regression analysis: Model 1 shows that male respondents were 26% more likely (OR=1.26: 95%CI 1.15, 1.37: P<0.001), those aged between 16 and 34 years were 61% more likely (OR=1.61: 95%CI 1.43, 1.80: P<0.001), and those from ethnic minority groups were 64% more likely (OR=1.64: 95%CI 1.40, 1.93: P<0.001) to have a less favourable and longer length of time since their last dental visit. Model 2 includes socio-economic position (SEP). The odds ratios for Model 1 variables remained essentially the same in Model 2. Compared with managerial, administrative and professional groups, those in intermediate occupations were 27% (OR=1.27: 95%CI 1.13, 1.43: P<0.001) more likely, those in routine occupations were 63% more likely (OR=1.63: 95%CI 1.47, 1.80: P<0.001) and those who were currently unemployed or who had never worked were 49% more likely (OR=1.49: 95%CI 1.22, 1.82: P<0.001) to report a longer time since their last dental visit. The final model again showed that the variables in Model 2 were very similar to those in Model 3. With regard to reported costs of treatment, in comparison with the reference group (costs of £19 or less) those who stated they paid £60 or more were 38% (OR=1.38: 95%CI 1.15, 1.37: P<0.001) more likely to report they had a longer time since their last dental visit whereas those who paid moderate amounts were 14% more likely (OR=0.86: 95%CI 0.77, 0.96: P=0.007) to have visited the dentist on a more

frequent basis. For those who perceived they needed treatment, they were over two and half times more likely (OR=2.61: 95%CI2.37, 2.86: P<0.001) to report greater duration since last dental visit. With regard to communication, those who stated that the dentist had not listened to them were 68% more likely (OR=1.68: 95%CI 1.43, 1.97: P<0.001) to have a greater duration since their last dental visit and those respondents who extremely dentally anxious were 67% more likely (OR=1.67: 95%CI 1.45, 1.92: P<0.001) to have a greater length of time since last dental visit (Table 2). The final model, Model 3, explained 14% of the variance (R2=0.14: df 12: P<0.001).

All six of the two-way interactions of the psychosocial variables from Model 3 were also entered following all main fixed effects as shown in Table 2. Only one of these psychosocial interactions proved to be significant, namely the perception of treatment need by extreme dental anxiety (OR = 0.52; 95%CI: 0.40, 0.69:P<0.001). The improvement in fit of last dental care access duration was significant according the Log-likelihood ratio test (chi square (df1) = 22.85, p< 0.001). To interpret this interaction Figure 1 shows that 73% of respondents with low dental anxiety and with no perceived treatment need had visited the dentist within 6 months, whereas 76% of participants with extreme dental fear and a perceived treatment need had last visited the dentist beyond 7 months or more.

Discussion:

The aim of this secondary analysis of UK dental health survey data was to study first the function of psychosocial factors and whether their interaction (dental anxiety, costs and communication) mediates the relationship between perception of need and length of time since last dental visit, as a proxy for access to dental care.

The results demonstrated that, and in agreement with others [7], the length of time since the last dental visit was associated with demographic and psychosocial factors. The findings from the hierarchical logistic regression analysis demonstrated that while age, gender and ethnicity contributed 2% of the variance and socio-economic position provided an additional 2% the majority of the variance (10%) in the prediction of length of time since last dental visit, was explained by costs of treatment, perception of treatment need, communication and dental anxiety.

Therefore, these psychosocial factors behaved as hypothesized, that is acting to increase the time in accessing dental care. Armfield [5,6], Ramraj et al [8] and Muirhead et al [10] had noted, that in some instances, that associated costs of treatment could act as a barrier: for instance in middle income

households but not for lower and higher income households. This was not shown here. Apart from those in managerial, administrative or professional groups all others had a prolonged time between dental visits. Furthermore, those who paid small or larger amounts reported longer periods of time since last dental visit whereas those who had moderate costs were more likely to have visited the dentist in the last 6 months. This suggested that costs, as Ramraj et al [8] proposed, could represent other dimensions such as 'culture or geographical considerations'. It is of interest, however, that greater perception of treatment need was predictive of greater time interval between dental visits. Barker [9] in her exposition of Andersen's model suggest that a simple, direct relationship between need perception and dental visiting may not exist. Moreover, she proposes that there are 'indirect (mediating) effects' [9] which must be included to understand the complexity of the relationship between perception of treatment need and the interval between dental visiting. It is proposed, therefore, that psychosocial factors may act as mediating influences which affect the relationship between perception of need and dental visiting. Thus, when, all 6 two-way interactions from the 4 psychosocial variables (that is: costs, perception of need, communication, dental anxiety) were entered, only one of these proved to be significant. This was the perception of treatment need by extreme dental anxiety. Although this only contributed to a mere additional 0.3% of the variance, it demonstrated that dental anxiety mediated the relationship between perception of treatment need and time between dental visits. The increased time between dental visits represents an inequity in access between those who had a perceived treatment need and who were dentally anxious and with those who were non-anxious and had no felt need for treatment. While this interaction is suggestive of Tudor-Hart's inverse care law [15], the mediating effect of dental anxiety shows that those who have the greatest perceived need in terms of dental and psychological need are those who reported longer periods between visits. Thus, the identified, significant interaction of the psychosocial variables provided an important additional dimension with respect to those originally theorised by Cohen [2] and Finch et al [3]. Moreover, the identification of this interaction supports the NICE guidance [1] with regard to the importance of adopting a patient-centred approach in the assessment of the interval between recall visits.

There are limitations to this study associated with the use of a national data set from 2009. The appropriateness of using this data set together with its generalizability to others may be questioned. However, despite the age of this data set and that it is of 3 countries within the UK, the findings from this current secondary analysis are remarkably similar and support the results of other and more recent national surveys [5,6]. The decision to select the 6-month duration since last visit may seem at odds

with the NICE guidance. However, the majority of respondents indicated that their recall pattern was 6 months or less and so this decision to use 6 months as a cut-off was because the cut-off to 1 year would have placed a possible increase in error due to respondents being less clear regarding their last recall visit. It also calls into question whether dental practitioners at this time were adherent to the NICE guidance and patient assessment with regard to recall interval. Other possible limitations of dichotomizing the dental visiting variable is the potential loss of data and loss of variation between groups, however, the findings of this current secondary analysis are extremely clear and consistent with our hypothesis and are supported elsewhere in the literature [5,6,8-11].

We tested six potential psychosocial interactions because the large sample of data enabled us to test with reliability each assisted additional prediction following the fitting of the main effects as shown in Table 2. The interaction effect reported we believed was not trivial because of the high level of significance and the detail revealed in Figure 1 to illustrate the effect of dental anxiety upon the relationship between perceived treatment need and time between dental visits.

Therefore, we propose that the findings here add to the knowledge base and increase understanding of the function of psychosocial factors upon the length of time since the last dental visit. The length of time since the last dental visit has in essence been used as a proxy for access for dental care in order to address the research question. The use of proxies has been queried, with regard to assessing accessibility, however, as Ramraj et al [8] have pointed out, the importance of using proxies is that they may provide a further appreciation of the complexity of the interactions being investigated, as confirmed here.

Despite these limitations, the secondary analysis is supportive of previous work in the area of access to dental care [5,6,8-10]. It has shown that communication between dentists and patients [11] on a population basis acted as a barrier to dental care and that costs, as others had shown [8], was a complex variable with regard to the length of time since last dental visit. The complexity of the predictor variables was further demonstrated by the interaction of perceived treatment need with extreme dental anxiety. This suggested that inequities in accessing dental treatment were associated with interactions between some psychosocial factors. It may be proposed, therefore, that to reduce oral health inequities it is necessary to put in place health promotion strategies which address both upstream and

downstream factors. Thus there should be [i] policy changes with regard to costs of treatment to increase access to services and [ii] that dental health professionals should become proficient in communicating and managing dental anxiety in their patients. This would reduce the influence of dental fear upon the relationship between perception of need and increased dental visit interval time. The need remains to investigate further the mediating function of psychosocial variables in the prediction of access to dental care, so that oral health inequities may be addressed [16,17].

In conclusion, this study revealed that dental anxiety, communication and treatment costs acted as barriers to accessing dental care. Dental anxiety acted as a mediator in the relationship between perception of need and increased time interval between dental visits.

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There are no acknowledgments or competing interests associated with this study.

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Table 1 Comparisons of duration since last access to dental care by demographic and psychosocial factors[1]

Demographic Factor	Duration since last access to dental care ≤ 6mths n (%)	Duration since last access to dental care ≥7mths n (%)	X^2 (df)	P
Age group				
16-34 yrs	1210 (49)	1273 (51)		
35-54 yrs	2429 (60)	1611 (40)	85.37 (2)	<0.001
55 yrs and over	2684 (58)	1966 (42)		
Gender				
Male	2633 (53)	2327 (47)	44.66 (1)	<0.001
Female	3670 (59)	2523 (41)		
SEP				
Managerial + professional	2524 (63)	1343 (37)		
Intermediate	1130 (57)	918 (43)		
Routine + manual	1848 (50)	2101 (50)	158.70 (3)	<0.001
Long-term unemployed/never worked	288 (50)	393 (50)		
Ethnicity				
White	5534 (58)	4078 (42)	58.51(1)	<0.001
Other	368 (44)	470 (56)		
Costs of treatment				
<£19	3268 (58)	2318 (42)		
£20-£59	1666 (64)	938 (36)	73.44 (2)	<0.001
>£60	1214 (52)	1123 (48)		
Perception of treatment need				
Yes	1717 (40)	2560 (60)	777.17 (1)	<0.001
No	4563 (67)	2237 (33)		
D-P relationship: listening				
Yes	5900 (59)	4110 (41)	137.71 (1)	<0.001
No	392 (40)	598 (60)		
Dental Anxiety				
MDAS score: 5-18	5716 (60)	3888 (40)	180.99 (1)	<0.001
MDAS scores: 19+	550 (40)	816 (60)		

1. Non-classifiable data removed; hence all variables will not equal the total sample size

Table 2 Predicting duration since last access to dental care: the role of demography and psychosocial factors

	Model 1			Model 2			Model 3		
	OR	95%CI	p	OR	95% CI	P	OR	95% CI	p
Gender: female	1			1			1		
: male	1.26	1.15, 1.37	<0.001	1.27	1.17, 1.39	<0.001	1.31	1.20, 1.44	<0.001
Age: 55+ years	1			1			1		
16-34 years	1.61	1.43, 1.80	<0.001	1.64	1.46, 1.84	<0.001	1.55	1.37, 1.74	<0.001
35-54 years	1.00	0.91, 1.11	0.96	1.05	0.95, 1.16	0.31	0.95	0.86, 1.06	0.36
Ethnicity: White	1			1			1		
Other	1.64	1.40, 1.93	<0.001	1.58	1.35, 1.86	<0.001	1.53	1.29, 1.81	<0.001
SEP: Managerial and professional				1			1		
Intermediate				1.27	1.13, 1.43	<0.001	1.20	1.05, 1.36	0.005
Routine and manual				1.63	1.47, 1.80	<0.001	1.49	1.34, 1.66	<0.001
Unemployed/never worked				1.49	1.22, 1.82	<0.001	1.40	1.13, 1.72	0.002
Costs: <£19							1		
£20-£59							0.86	0.77, 0.96	0.007
£60+							1.38	1.23, 1.55	<0.001
Perception of treatment need: No							1		
Yes							2.61	2.37, 2.86	<0.001
D-P relationship: listening: Yes							1		
No							1.68	1.43, 1.97	<0.001
Dental Anxiety (MDAS): <18							1		
19-25							1.67	1.45, 1.92	<0.001
-2 log likelihood	11,702			11,609			10,924		
Df	4			7			12		
ΔX^2 (Δdf)				93 (3)			685 (5)		
P	<0.001			<0.001			<0.001		
R^2	0.02			0.04			0.14		

Model 1: Adjusted for gender, age and ethnicity

Model 2: Adjusted for variables in Model 1 plus socio-economic position (SEP) item

Model 3: Adjusted for variable in Model 2 plus costs of dental care, perception of need, dentist-patient relationship (listening) and dental anxiety (MDAS)